Measurement of $W^{\pm}$ and Z^0 bosons single-spin asymmetry in transversely polarized pp collisions at STAR

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Abstract

The Sivers function $f_{1T}^{\perp}$ describes the correlation of parton transverse momentum with the transverse spin of the nucleon. There is evidence of a quark Sivers effect in semi-inclusive DIS (SIDIS) measurements. In SIDIS, the quark Sivers function is associated with a final state effect from the gluon exchange between the struck quark and the target nucleon remnants. On the other hand, for the virtual photon production in the Drell-Yan process, the Sivers asymmetry appears as an initial state interaction effect. As a consequence, the quark Sivers functions are of opposite sign in SIDIS and in Drell-Yan and this non-universality is a fundamental prediction from the gauge invariance of QCD. The experimental test of this sign change is one of the open questions in hadronic physics, and can provide a direct verification of TMD factorization. While luminosities required for a precise measurement of asymmetries in Drell-Yan production are challenging, $W^{\pm}/Z^0$ production is equally sensitive to the predicted sign change and can be well measured at the STAR experiment. The results can also provide essential input to study the evolution effects of the Sivers function, because of the high Q^2 in W/Z^0-production. The W boson kinematics are fully reconstructed from the decay lepton and the recoil, by employing a MC-based correction, thus avoiding the dilution that an asymmetry reconstructed from the decay lepton only would suffer. We will present progress toward the first measurement of the transverse single spin asymmetry, A_N, of the $W^{\pm}/Z^0$ bosons from the STAR experiment at RHIC.